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A/PROV

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(b)(2).

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☐ Additional inventors are being named on the ___ separately numbered sheets attached hereto.

TITLE OF THE INVENTION (280 characters max)

MULTIPLE LAMP ILLUMINATIONS FOR PROJECTION DISPLAYS

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* [2]
☒ Drawing(s) *Number of Sheets* [5]
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number _____
☐ Other *(specify)* _____

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☐ Applicant claims small entity status. See 37 CFR 1.27
☐ A check or money order is enclosed to cover the filing fee
☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 02-2135
☐ Payment by credit card. Form PTO-2038 is attached.

Filing Fee Amount: $160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____ Date June 21, 2002

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REGISTRATION NO. 31,414
Docket Number: 2138-271

USE ONLY FOR FILING PROVISIONAL APPLICATION FOR PATENT

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Multiple Lamp Illuminations for Projection Displays

For high power projectors, high power xenon lamps in the multi-kilowatt ranges are often used to provide screen output of a few thousand lumens. The low efficiency of the xenon lamps and the long arc gap at these high output powers makes the unit expensive and bulky. As a result, high power projectors are designed using a few lower power lamps becomes the favorable approach. This lower power metal halide, UHP, etc. type of lamps has higher efficiency, smaller arc gap, and lower cost. Thus, the resulting projector is more compact, lower cost, and produces equal or high output when compared with the xenon lamp systems. One issue is that combining the outputs of two or more lamps usually results in loss of brightness from the lamp, thus reduces the efficiency of the system.

In this invention, a light pipe system is described for combining outputs from two or more lamps into a single output light pipe without loss of brightness. This combining system is most suited to be used with the dual paraboloid reflector system. Traditional elliptical reflector system or paraboloid reflector system with a focusing lens can also be used. In these two cases, the brightness is partially loss in the elliptical and parabolic reflectors. The power combining system still preserves the brightness of the light at the input of this system.

Figure 1 shows a schematic diagram of the power combining system using two dual paraboloid reflector systems. It consists of two sets of dual paraboloid reflector (DPR) system each consists of a DPR, a lamp, a retro-reflector and a tapered light pipe. The tapered as shown is designed with a convex output surface for further increase in efficiency. A flat output can also be used. The light from the arc of the lamp is reflected and focused onto the input of the tapered light pipe and transformed by the tapered and convex output surfaced to the desired area and angle. Due to mechanical constraint, the output is reflected by 90 degrees, or other appropriate angles, by a prism, and coupled into the output light pipe. The same arrangement is done for the second set of DPR. The two inputs to the output light pipe is then mixed and produces a final single output, which preserves the brightness of the arc and a uniform spatial profile for the projection display.

The output light pipe can be straight as shown or can be tapered depending on the output dimension and angle desired. Although the embodiment shows the used of a prism for reflection, other reflective means, like a mirror, can be used. The prism provides a continuation of the waveguide, which can be more efficient. The slanting face of the prism can be bare providing total internal reflection, or can be coated for reflection depending on the numerical aperture (NA) of the system.

Figure 2 shows a perspective view of the power combining system. As shown, the input and output light pipes are straight. They can also be tapered as described above. In general, the light input to the input light pipe can come from the DPR system or from the traditional elliptical reflector, or from a parabolic reflector with a focusing lens, or both. The lamp used can be the same type of lamp with the same wattage. They can be

different type of lamp with different wattages, different categories, etc. For example, one lamp can be 200W xenon lamp, and the other can be a 100 UHP lamp. In another case, the lamps can be chosen such that the emission spectrum can be different such that the output spectrum can be adjusted with greater freedom.

Figure 3 shows another embodiment of this invention using two light pipes and two elliptical reflector systems. The outputs from these two lamps are combined and produce a single output.

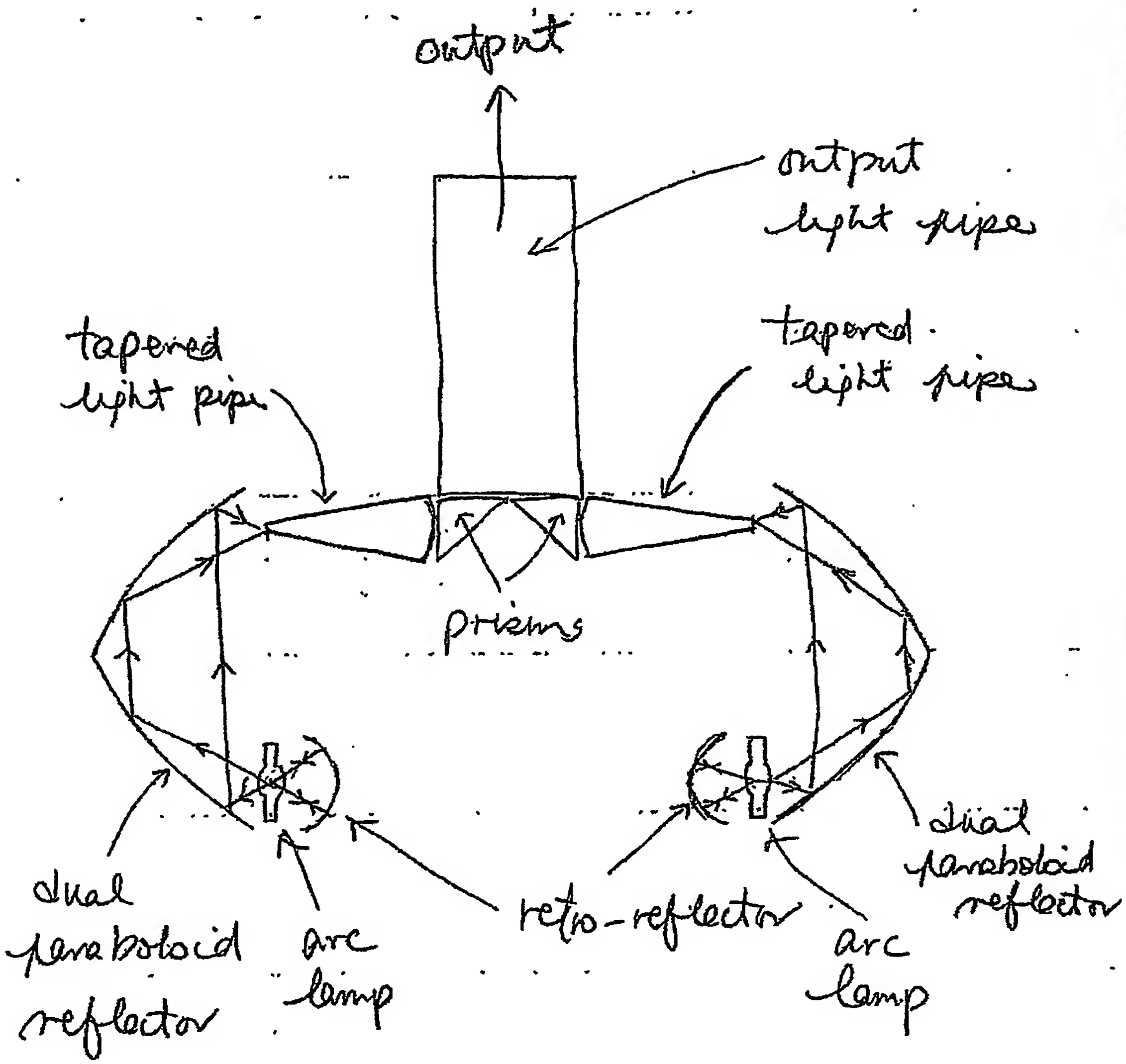
Although the above embodiments are designed for combining 2 lamps, as shown in Figure 4, outputs from 4 lamps can be combined to a single output as shown. In this case, 4 input light pipes and 4 prisms are used. Again, the light pipes can be straight or tapered; the light input can come from various types of reflector, types of lamps, etc. to produce the desired output.

Figure 5 shows another embodiment of the invention in which extra connecting light pipes are added to the system. The connecting light pipes acts to change the direction of the input. Depending on the physical implementation, one or more of the inputs can be implemented with the connecting light pipe. These can be applied to the 2-lamp or 4-lamp systems, or other systems.

Not drawn, the same invention can be applied to other polygonal input and output light pipes. For example, for a triangular output light pipe, the input face can be divided input 3 portions and a 4-face prism can be used to reflect light from a triangular input light pipe to the output light pipe. A 5-sided output light pipe can also be implemented by having 5 4-face prism and 5 triangular input light pipes. Other polygonal output light pipes can be implemented in a similar fashion.

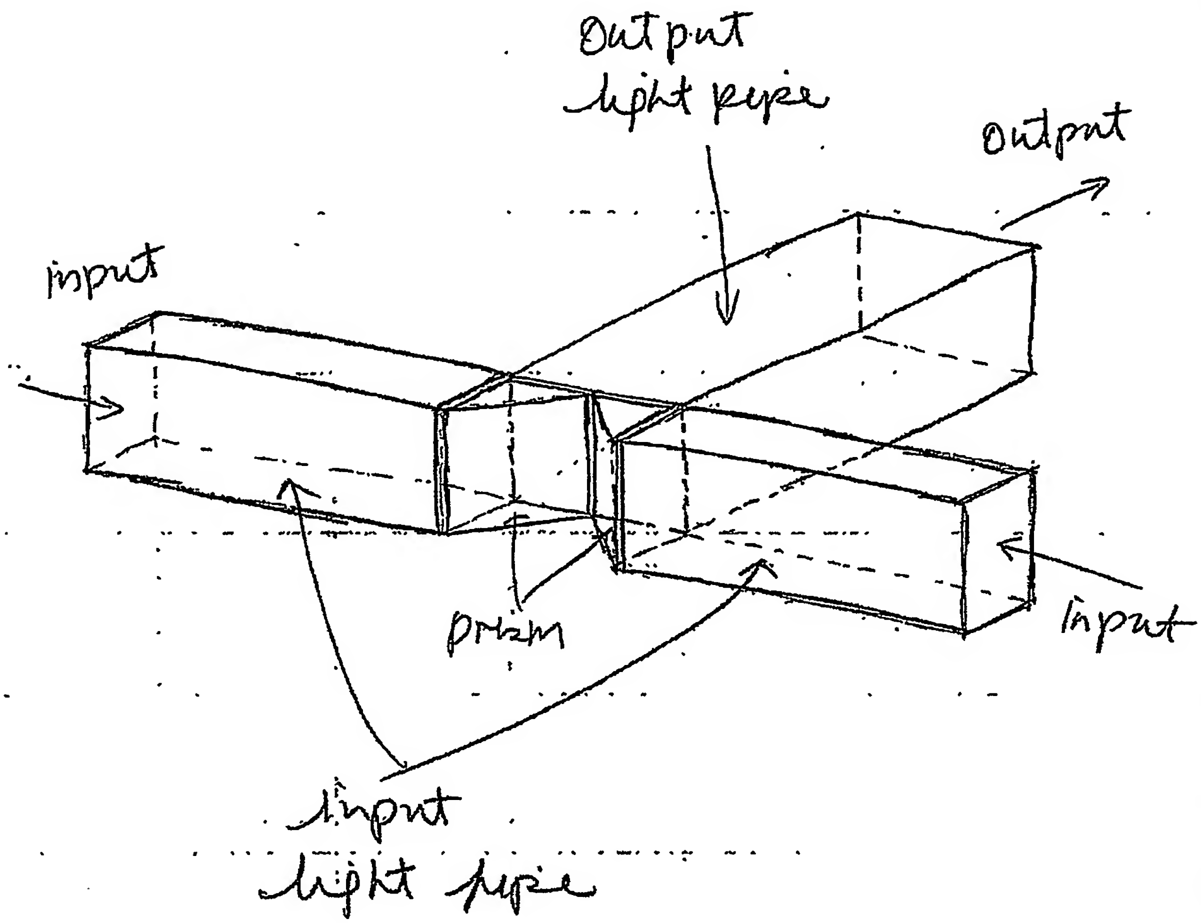
Although the above embodiment shows that the input of the output light pipe is divided equally amount the lamps, unequal divisions can also be implemented. For example, when lamps with different arc sizes are used, the input area of the output light pipe can be divided unequally such that the overall output is optimized based on the unequal inputs.

The light pipes can be made from solid glass, quartz, etc., or can be hollow. Lamps used can be metal halide, UHP, mercury, high-pressure mercury, filament, sodium, light emitting diodes (LEDs), etc.



- output light pipe – straight or tapered.
- tapered light pipe – convex or flat output

Figure 1.



- input light pipe - straight or tapered
- output light pipe - straight or tapered
- input from focus light of elliptical or dual paraboloid reflectors

Figure 2

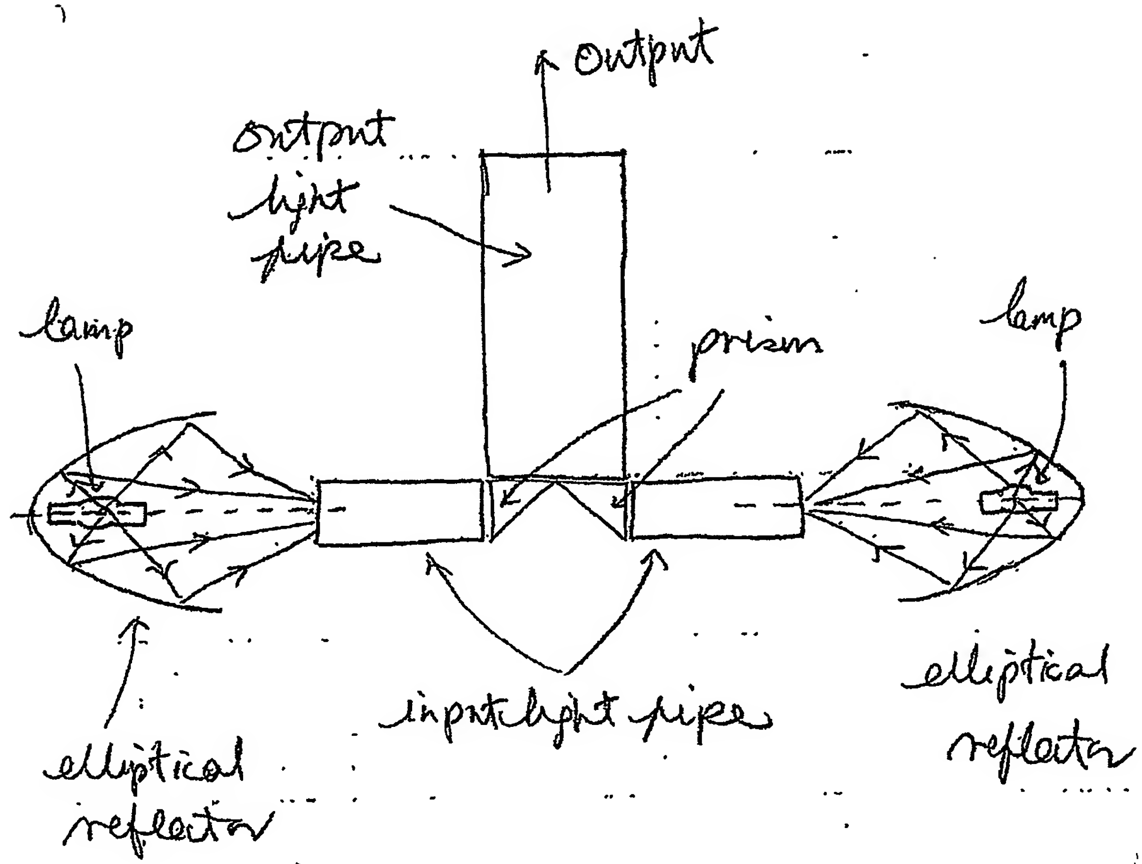

output
output light pipe
lamp
prism
lamp
elliptical reflector
input light pipe
elliptical reflector

Figure 3

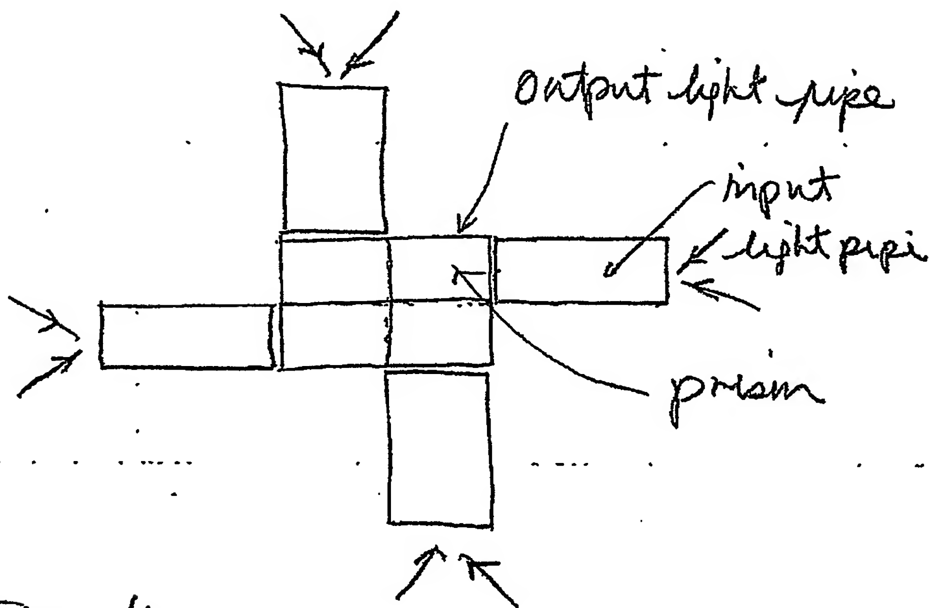


Figure 4

view along axis of output light pipe

- focus light from elliptical or dual paraboloid reflectors
- input and output light pipes can be straight or tapered.

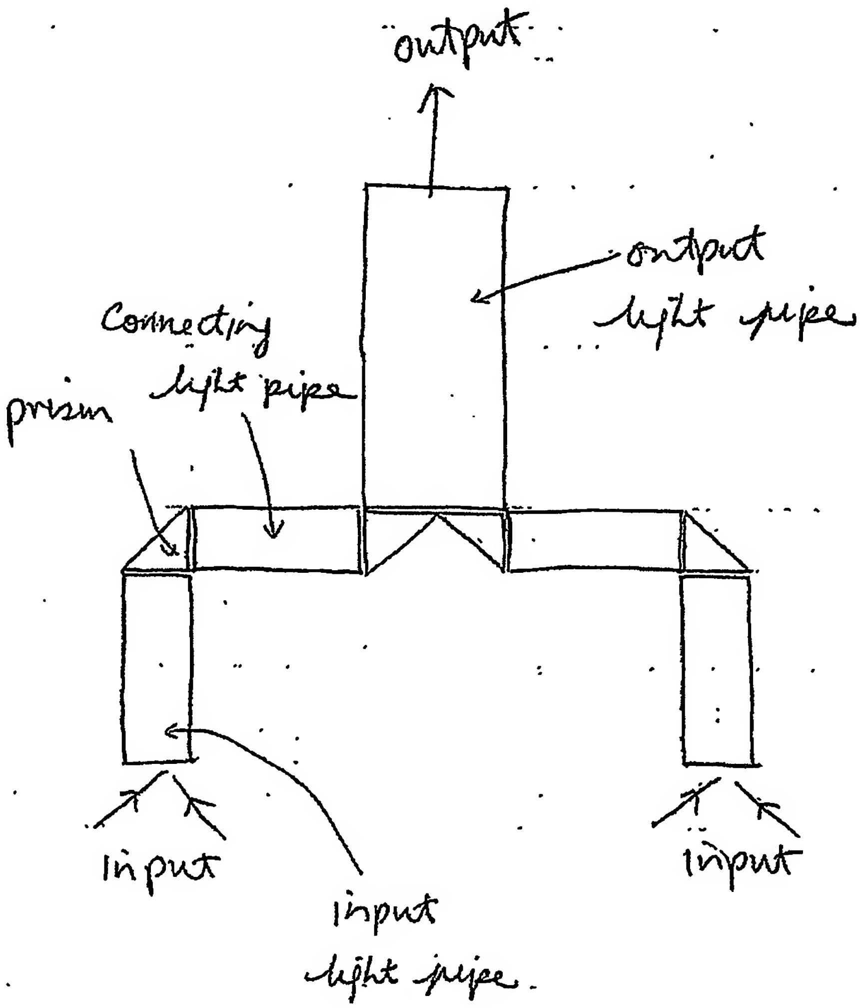

output
output light pipe
Connecting light pipe
prism
input
input
input light pipe

Figure 5